

## **Imitation In Undergraduate Teaching and Learning**

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### **Abstract**

Research in developmental psychology and neuroscience has demonstrated the critical role of imitation in human learning. Self-report questionnaires collected from 456 undergraduate students in two U.S. institutions and one Chinese institution demonstrated that undergraduate students from both U.S. and Chinese cultures used various imitations in learning, and most undergraduate students perceived those imitations to have positive effects on their learning. Gender, grade-level, disciplinary, and especially, cultural differences of undergraduate students' uses of imitation and their perceptions of the usefulness of those imitations varied in ways that suggest the significance of broad norms using imitation in teaching and learning in higher education. This study contributed to a better understanding of the significance of imitation in undergraduate student learning across cultures, provided implications for teachers and students in using imitation as an effective teaching and learning tool, and offered important avenues for future research on the topic.

**Keywords:** Imitation, undergraduate student, teaching, learning, international education.

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Imitation is generally thought to be a low-level, non-cognitive copying behavior that may inhibit creativity in learning (Bender, 1979; Deahl, 1899; Warnick, 2008). Therefore, it is rarely studied in university classroom, and the few existing research mainly focuses on avoiding copying as a pedagogical approach in writing and composition classroom (Boyd, 1991; Brooke, 1988; Twomey, 2003) and science classroom (Darling, 2001). However, recent developmental psychological and neuroscientific research has demonstrated that imitation requires a high level of cognitive capacity, and is a critical ability unique to human beings (Meltzoff, 2005; Meltzoff & Decety, 2003). It develops in infancy and continues throughout adulthood, and is associated with a variety of cognitive abilities such as intelligence, emotion, and communication (Meltzoff & Prinz, 2002; Nadel & Butterworth, 1999); thus plays an essential role in learning (Hurley & Chater, 2005; Rogers & Williams, 2006). However, most studies with the updated understanding of imitation focused only on the learning and teaching of infants and children, and ignored university students. Whether and how undergraduate students use imitation and what the effects of imitation are on their learning need further exploration.

There is a growing body of literature examining the critical effects of imitation in cultural transmission and development (Hurley & Chater, 2005; Meltzoff & Prinz, 2002; Shea,

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2009; Whiten McGuigan, Marshall-Pescini, & Hopper, 2009). How university students from different cultures use and perceive imitation is also worth examining. The present study aimed to understand U.S. and Chinese undergraduate students' perceptions of imitation in learning and to explore implications for teaching and learning in international education.

## Review of Relevant Literature

### *Definitions and Mechanisms of Imitation*

In recent decades, imitation has been broadly studied from a variety of perspectives, including biology, psychology, neuroscience, philosophy, and sociology (Hurley & Chater, 2005; Meltzoff & Decety, 2003; Rogers & Williams, 2006). Therefore, it is usually defined very generally with a focus on specific processes and possible consequences (Zentall, 2006). Hurley and Chater (2005) described imitation as follows:

It occurs when the observer's perception of the model's behavior causes similar behavior in the observer, in some way such that the similarity between the model's behavior and that of the observer plays a role, though not necessarily at a conscious level, in generating the observer's behavior. (p. 2)

The "similar behavior" in this definition emphasizes that imitation goes beyond simply copying the same behavior. It requires participants to understand the goal of a behavior and, more importantly, to understand that the goal can be achieved by other behaviors; thus participants can use a different means to achieve the same goal of the observed behavior, and it is this ability that distinguishes imitation from other forms of social learning (Hurley & Chater, 2005; Zentall, 2006). For example, Gergely, Bekkering, and Kiraly (2002) found that when children were shown the behavior of turning on a light by pushing it with the head, whether they imitated the head push or not depends on whether the demonstrator's hands were free or not. These children understood the goal was to turn on the light and the demonstrator used the head because her hands were occupied; thus these children imitated the demonstrator's behavior – using their hands rather than their heads – of turning on the light. Rogers and Williams (2006) provided more examples in their definition of imitation:

It involves the ability to learn socially from others and to incorporate behaviors seen in others into the behavioral repertoire. It involves the connections between the behavior we observe and the behavior we enact. It can concern simple actions such as opening a container, or it can be as advanced as incorporating other people's ideas when writing a book. It is the means by which we absorb, repeat, and so become integrated with human culture. ...., it is a process with irreducible simplicity, and yet the most sophisticated robotics experts still struggle to produce any machine that can perform the function. (p. x)

Understanding the goal of an observed behavior and choosing a different but appropriate way to achieve the same goal requires high level cognitive abilities. Hence, imitation is not a low-level, non-cognitive behavior (Hurley & Chater, 2005; Williamson, Jaswal, &

Meltzoff, 2010). On the contrary, the flexible relationship between the observed behavior and the enacted one is the core to many social-cognitive capacities, including empathy, communication, and intersubjectivity (Eckerman, 1993; Meltzoff & Prinz, 2002; Nadel & Butterworth, 1999; Rogers & Williams, 2006). Therefore, imitation becomes understood as a unique and critical ability that belongs only to human beings (Meltzoff & Decety, 2003).

Several possible mechanisms of imitation have been proposed based on research in neuroscience and developmental psychology. The discovery of mirror neurons provides a neuroscientific explanation for the high frequency of imitation in social interactions (Rizzolatti, Fadiga, Gallese, & Fogassi, 1996). Mirror neurons were first found in macaque monkey brains. They fired when the monkey performed an action, as well as when this monkey observed someone else performing a similar action (Rizzolatti & Craighero, 2004; Rizzolatti et al., 1996). More research using advanced technology, such as brain imaging techniques or transcranial magnetic stimulation, found that mirror neurons also exist in human brains (Iacoboni et al., 2001; Koski, Iacoboni, Dubeau, Woods, & Mazziotta, 2003; Mukamel, Ekstrom, Kaplan, Iacoboni, & Fried, 2010). The findings indicated that mirror neurons in human brains are activated not only by doing the actions or achieving the goals of those actions, but also by processing how to achieve the goals (Buccino et al., 2001; Calvo-Merino, Glaser, Grèzes, Passingham, & Haggard, 2005; Iacoboni et al., 2001; Koski et al., 2003; Van Gog et al., 2009). Therefore, human beings can not only perform an observed action or understand the goal of this action, but also choose a variety of behaviors or methods to achieve the same goal, which is essential to a genuine imitation.

Some researchers, however, have asserted that mirror neurons alone are not enough to produce imitation (Hurley, 2008; Rizzolatti, 2005; Zentall, 2006). Imitation may require a deeper level of cognitive processing in applying novel behaviors to new environments. People need to not only internally represent but also externally manifest the observed behaviors (Rizzolatti, Fogassi, & Gallese, 2001). Therefore, cognitive mechanisms such as perspective taking may also be essential for human beings to perform an imitation (Hurley 2008; Zentall, 2006; Van Gog, Paas, Marcus, Ayres, & Sweller, 2009).

### ***Imitation and Learning***

Research in developmental psychology has found that imitation exists in early infancy and grows in parallel with multiple cognitive abilities throughout adulthood (Heyes, 2001; Heyes & Ray, 2000; Meltzoff, 2005, 2007). Experiments demonstrated that infants – even those as young as 40 minutes – could imitate the adults' behaviors (Jones, 2006; Meltzoff & Moore, 1983). Therefore, infants are born with the ability to imitate, and this ability is not a reflex but a functional activity (Kugiumutzakis, 1993; Meltzoff & Moore, 1977). Imitation serves as the root for infants and children to understand the mental states of themselves and others, thus to develop social cognition (Meltzoff & Decety, 2003). It helps infants and children acquire experience and learn cognitive and motor skills such as language and emotional expressions (Meltzoff, 2002, 2005; Uzgiris, 1981), and develop communication skills (Nadel & Camaioni, 1993), social relationships (Eckerman, 1993),

and moral conscience (Forman, Aksan, & Kochanska, 2004). Adults have also shown a strong tendency to imitate in social interactions (Brass, Bekkering, Wohlschläger, & Prinz, 2000; Brass, Zysset, & Von Cramon, 2001; Press, Bird, Walsh, & Heyes, 2008; Rumiati, Carmo, & Corradi-Dell'Acqua, 2009). Neuroscientific research has demonstrated that imitation recruits certain brain regions to establish relationships between the self and others and also to distinguish between the perspectives of self and other (Meltzoff & Decety, 2003), thus it helps adults understand others' goals (Meltzoff, 2005), exchange social attitudes (Cook & Bird, 2011), and establish empathy and intersubjectivity (Decety, Chaminade, Grèzes, & Meltzoff, 2002).

Imitation is essential to many socio-cognitive abilities; therefore, it "accelerates learning and multiplies learning opportunities" (Meltzoff, Kuhl, Movellan, & Sejnowski, 2009, p. 285). Research found that imitation is an effective and efficient way to learn, and has identified several factors influencing infants and children's effective imitation in learning (Meltzoff, 2002, 2005, 2007; Van Gog et al., 2009). Long-term memory plays an important role in performing imitation (Hanna & Meltzoff, 1993; Meltzoff, 2005). Studies demonstrated that infants and children can imitate the same behavior not only immediately but also after a one-week and up to even a two- or four-month delay (Barr, Dowden, & Hayne, 1996; Meltzoff, 1988, 1995). This delayed imitation can also happen across various contexts (Hanna & Meltzoff, 1993). Children saved the information picked up through previous observation for later use (Meltzoff, 1988); therefore, they used their prior experiences to guide imitation (Williamson, Meltzoff, & Markman, 2008). Live demonstration, including face-to-face interactions or videos, facilitates imitation and learning (Meltzoff, 2005, 2007). Infants and children imitate more and learn more effectively in dyadic interactions or group discussions (Meltzoff, 2005). They also learn significantly better through face-to-face communicating with live speakers than listening to audio recordings (Kuhl, Tsao, & Liu, 2003; Meltzoff et al., 2009) or television programs (Meltzoff, 1988). Infants and children show a strong tendency to identify and imitate models in learning (Masters, 1972; Warnick, 2008). They tended to imitate adults or older or same-age peers much more than they imitated younger children; and they even adjusted their performance standards when imitating people at different ages (Brody & Stoneman, 1981; Davidson & Smith, 1982). Research also found that infants and children imitate various models, including music or robots (Jones, 2006; Tennie, Call, & Tomasello, 2006).

Imitation involves complicated cognitive capacities and plays a critical role in human learning (Hurley & Chater, 2005; Rogers & Williams, 2006). Previous research has demonstrated that both infants and adults use imitation in social interactions (Brass et al., 2000, 2001; Meltzoff, 2005, 2007; Rumiati et al., 2009), but few studies focused on adults' imitation (Carmo & Rumiati, 2009; Cook & Bird, 2011), and even fewer examined the effects of imitation on adults learning. Pyle (2010) found that imitating mentors or coaches is important for individual adult learning. Zhou and Guo (2012) and Zhou (2012) found that teacher's imitation of undergraduate students' behaviors in teacher-student interactions has a positive effect on teacher-student relationships and students' learning outcomes as well. More research on undergraduate students' imitation and its effects on learning are needed to examine learning and instruction in higher education.

### **Imitation and Culture**

Imitation and culture are closely related to each other (Hurley & Chater 2005). Nielsen (2012) proposed that imitation provided a rapid transfer between generations of a vast amount of information and skills and it also served as a foundation upon which various aspects of human cultures can be built. He found that when children imitated adults they usually copy unnecessary and arbitrary actions, which is called overimitation; and it was this overimitation persistently replicated how an object is produced or used and hence transmitted cultural ideas and practices across generations, including personal behaviors like facial expression, eye contact, posture, gaze, touch, gestures, and voice and tone and pitch, and instrumental acts like skills, traditions, language, and tools (Williamson, et al., 2010). Rogers (1999) and Rogers and Williams (2006) also found that imitation was used as a critical means to develop awareness of culture. More studies found that people in a community used imitation to build their culture (Whiten & Ham, 1992) and an outsider would use imitation to become part of the culture (Hung, 1999).

Although imitation plays an important role in cultural transmission and development, few studies had actually compared imitation in different cultures. Losin et al. (2012) found that American participants with European, African, and Chinese backgrounds had more neural activities in imitating people from the other two cultures. McCroskey et al. (1996) compared participants from Australia, Finland, Puerto Rico, and the United States and found that the behaviors that violated cultural expectations may have negative effects on cognitive learning. Therefore, it is worth further examining imitation in different cultures.

The present study was guided by three interrelated research questions:

Question 1: Do undergraduate students across three different educational contexts, two in the U.S. and one in China, engage in particular imitative behaviors, such as copying examples, following teachers' behaviors, etc.?

Question 2: Do students believe these behaviors led to positive or negative learning outcomes? And, if so, do students across the three educational contexts differ in the types of imitation uses and in the perceived usefulness of the imitations?

Question 3: Given the cultural differences in imitative behaviors noted in the literature (Losin, et al., 2012), are there differences in the perceived imitative behaviors adopted by the U.S. and Chinese students?

## **Methods**

Previous studies on imitation used either a direct observation method or a within-subject design to examine imitation in social interactions (Hurley & Chater, 2005; Meltzoff, 2005; Rogers & Williams, 2006; Zhou, 2012). Yet, research demonstrated that imitation is sometimes covert, that is, invisible or unclear to the observers (Decety, 2006; Heyes, 2011). For example, people used delayed imitation frequently, and it is difficult to identify their imitation across time and contexts using direct observations. Another significant

problem is that imitation allows the participants to use different methods to achieve the goal of the behavior they observed. People have flexible choices in performing imitation and they usually do not just copy the behaviors they observed. For example, children chose to turn on the light with their hands rather than heads (Gergely et al., 2002), or people might incorporate others' ideas in a writing assignment (Rogers & Williams, 2006). The mismatch between the observed behavior and the response raises problems for the assessment of imitation through direct observation. Thus, observation methods are unable to capture covert imitation and focus only on the overt imitation that is "the disinhibited tip of the iceberg of continual covert imitation" (Hurley, 2008, p. 5). In order to have access to both overt and covert imitation, including delayed and mismatched imitations, the present study used two self-report questionnaires to examine undergraduate students' imitation.

### **Participants**

Four hundred and fifty-six undergraduate students from two U.S. and one Chinese institutions voluntarily participated in the study. Table 1 shows the demographics of the

**Table 1. Demographics of Participants in Three Institutions.**

Demographics	Percentage			
	1st US Institution	2nd US Institution	US	Chinese Institution
Gender				
Female	58.2	82.2	36.5	
Male	38.6	17.8	63.5	
Unidentified	3.2	0.0	0.0	
Grade-level				
Freshmen	27.1	3.0	69.2	
Sophomore	28.3	16.8	10.6	
Junior	24.7	16.8	7.7	
Senior	19.9	63.4	12.5	
Discipline				
Art	7.2	3.0	1.9	
Business	15.5	3.0	9.6	
Other	4.0	3.0	10.6	
Science and math	32.7	10.9	45.2	
Social science	31.5	78.1	32.7	
Undecided	9.2	2.0	0.0	

*Note.*  $N$  (1st US Institution) = 251.  $N$  (2nd US Institution) = 101.  $N$  (Chinese Institution) = 104.

All participants responded to two questionnaires. After completing Questionnaire One, they immediately responded to Questionnaire Two. At the beginning of both questionnaires, the participants were informed of the purpose of the study and asked to focus on their experiences of imitation while answering the questionnaire.

participants in three institutions. The first U.S. institution is a large, public university where 251 students were recruited randomly in the waiting room during walk-in hours of an undergraduate advising program on campus between February 2012 and April 2012. Their mean age was 20.1 years ( $SD = 2.46$ ). The second U.S. institution is a small public college where 101 undergraduate students were recruited by visiting classrooms randomly in August and September, 2013. Their mean age was 24.9 ( $S = 8.1$ ). The Chinese institution is a large public university where 104 students were recruited randomly from four College English classes. The mean age was 19.4 ( $SD = 1.78$ ). No international student is included in the study.

### **Measures**

Two questionnaires were constructed specifically for the present study. They were developed from two resources. One resource is an existing 43-item questionnaire – Questionnaire about the Popular Conceptions of Learning (QAPCOL) (Cantoia, Giordanelli, Perez-Tello, & Antonietti, 2011) which examines worldwide K-16 students' conceptions of learning, including students' learning habits (18 items), students' attitudes toward learning (17 items), and students' mistakes in learning (8 items). One of the major findings of the QAPCOL was students' uses of imitation in learning, including students' learning from others' demonstrations, experts' explanations, peer discussions, collaborations, knowledge verification, observations, and mistakes. Another resource is the latest developmental psychological and neuroscientific findings on children's imitation in learning, including imitating videos, real persons, role models or peers' attitudes, examples, teachers' behaviors, and delayed imitation (Hanna & Meltzoff, 1993; Hurley & Chater, 2005; Meltzoff, 2002, 2005, 2007; Meltzoff & Decety, 2003, Nadel & Butterworth, 1999, Rogers & Williams, 2006; Warnick, 2008). Based on these two resources, two questionnaires were developed to examine whether and how undergraduate students use and perceive imitation in their learning.

Questionnaire One focused on the first research question: do undergraduate students across three different educational contexts engage in particular imitative behaviors? (e.g., "I followed, maybe automatically, teachers' behaviors in class, like taking notes or turning the pages."), and Questionnaire Two examined the second research question: do students believe these behaviors led to positive or negative learning outcomes? (e.g., "I learned better when I followed teachers' behaviors in class."). Due to the nature of the two research questions, most of the items on the two questionnaires were parallel. Students reflected their use of a certain imitation in Questionnaire One, and then evaluated the effect of this particular imitation on their learning in Questionnaire Two.

Before answering the questionnaires, students were instructed to focus on their imitation in learning. Whether and how undergraduate students use various kinds of imitation is one of the research questions, thus no example was given purposely. None of the students asked for clarification while answering the questionnaires. Imitation helps students set and meet different expectations in various learning settings, thus learning was not defined

specifically in Questionnaire Two. Students were expected to interpret learning expectations based on the various settings described in each item.

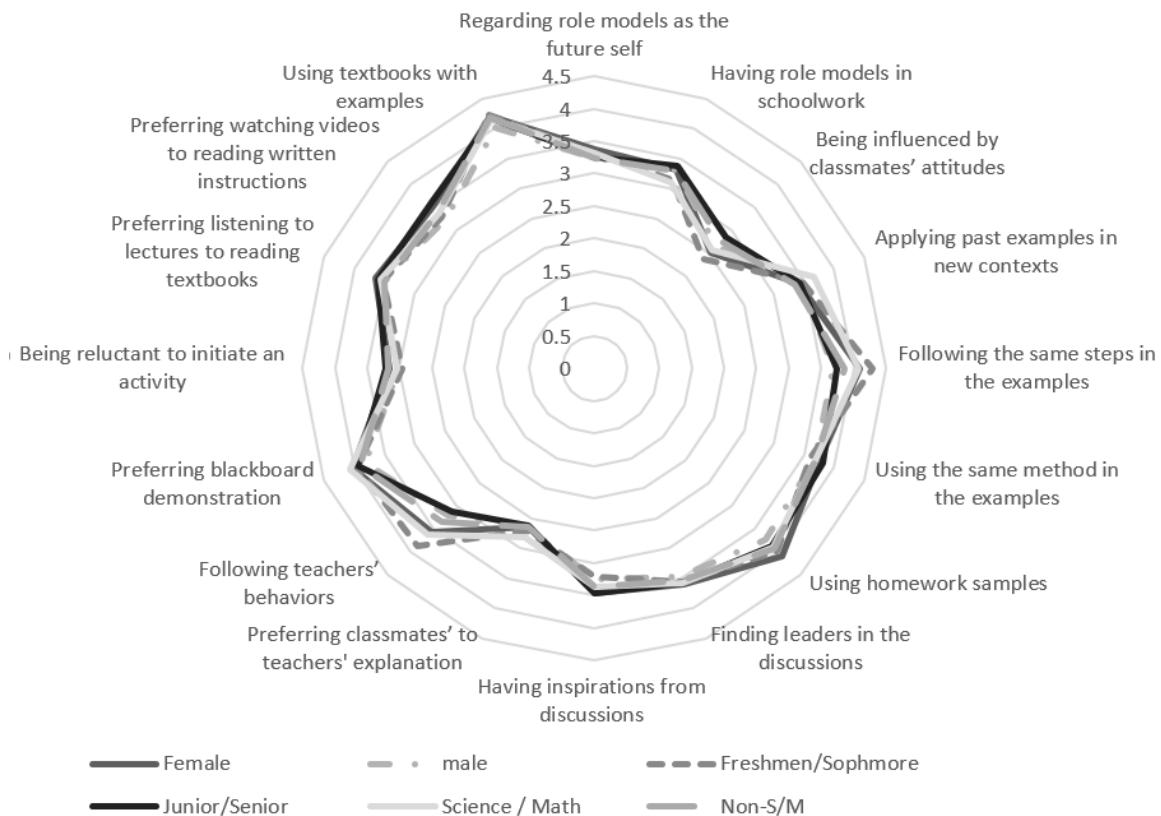
Students rated their agreements with each statement on a 5-point Likert-type scale anchored at 1 (Strongly disagree) and 5 (Strongly agree). The order of items within two questionnaires were randomized. The internal consistency reliability, Cronbach's alpha, between the two questionnaires was 0.94.

A Principal Axis Factor (PAF) with a Varimax (orthogonal) rotation of the 16 Likert scale questions from Questionnaire One was conducted on data gathered from 456 participants. An examination of the Kaiser-Meyer Olkin measure of sampling adequacy suggested that the items were factorable ( $KMO = .609$ ). Four factors were therefore grouped as: learning materials (Cronbach's  $\alpha = 0.73$ ), learning activities (Cronbach's  $\alpha = 0.69$ ), problem solving processes (Cronbach's  $\alpha = 0.63$ ), and learning attitudes (Cronbach's  $\alpha = 0.83$ ). Cronbach's alpha for all the items in Questionnaire One was 0.87. A Principal Axis Factor (PAF) with a Varimax (orthogonal) rotation of the 18 Likert scale questions from Questionnaire Two was conducted on data gathered from 456 participants. An examination of the Kaiser-Meyer Olkin measure of sampling adequacy suggested that the items were factorable ( $KMO = .771$ ). Four factors were hence grouped: the effects of imitations in learning materials (Cronbach's  $\alpha = 0.71$ ), the effects of imitations in learning activities (Cronbach's  $\alpha = 0.75$ ), the effects of imitations in problem solving processes (Cronbach's  $\alpha = 0.68$ ), and the effects of imitations in learning attitudes (Cronbach's  $\alpha = 0.88$ ). Two items were added to examine the effects of imitations in general. The Cronbach's alpha for all 18 items in Questionnaire Two was 0.90.

## Results

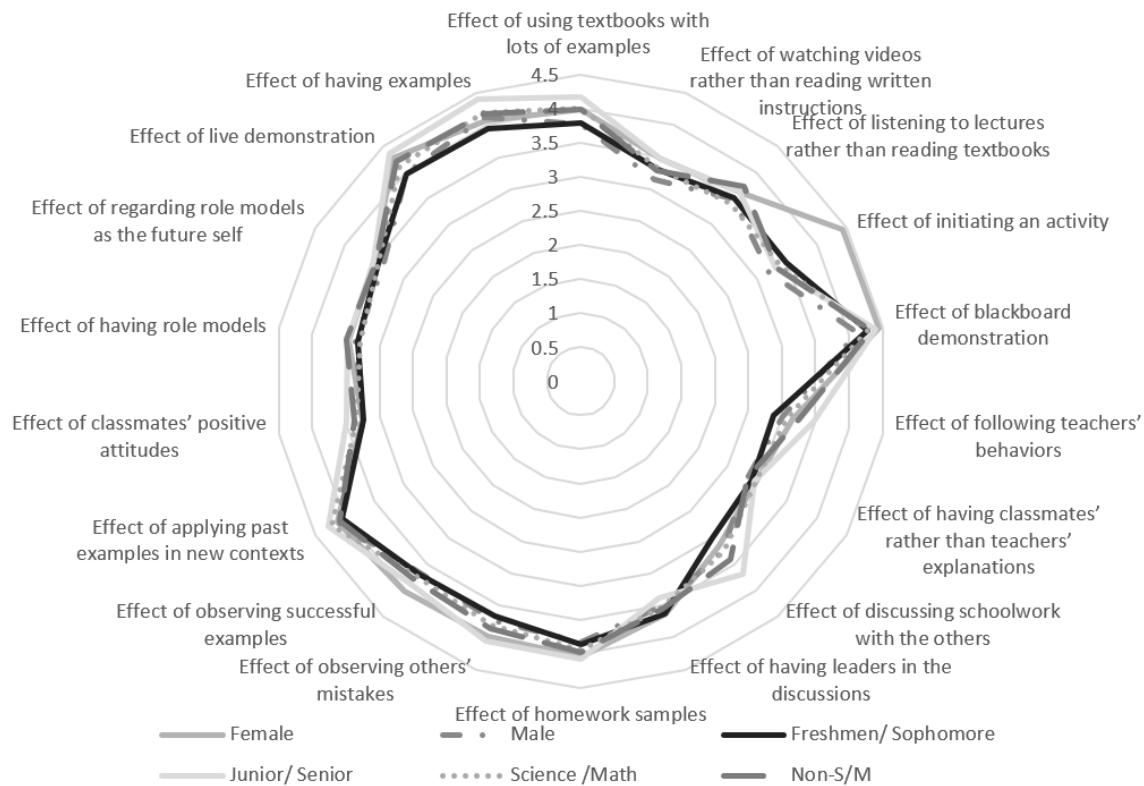
### ***Undergraduate Students' Uses and Perceptions of Imitations across Genders, Grade-levels, and Disciplines***

Using  $t$ -tests of mean differences, the demographic data were compared on three variables – gender, grade-level, and discipline. The gender, grade-level, and disciplinary differences in undergraduate students' uses of imitation in learning are presented in Figure 1. Female students reported using more imitations than male students in 13 out of 16 imitations, and using significantly more in five items – Preferring watching videos to reading written instructions, Following teachers' behaviors, Having inspirations from discussions, Using homework samples, and Following the same steps in the examples. Juniors and seniors reported using more imitations than freshmen and sophomores in eight items, and significantly more ones in five items – Preferring watching videos to reading written instructions, Being reluctant to initiate an activity, Having inspirations from discussions, Using the same method in the examples, and Being influenced by classmates' attitudes, while significantly fewer imitations in two items – Following teachers' behaviors and Following the steps in examples. Science and math students reported using more imitations than non-science and math students in nine items, with significantly more in three ones – Following teachers' behaviors, Following the same steps in the examples, and Applying past examples in new contexts.



**Figure 1. Gender, Grade-level, and Disciplinary Differences of Undergraduate Students' Uses of Imitation in Learning.**

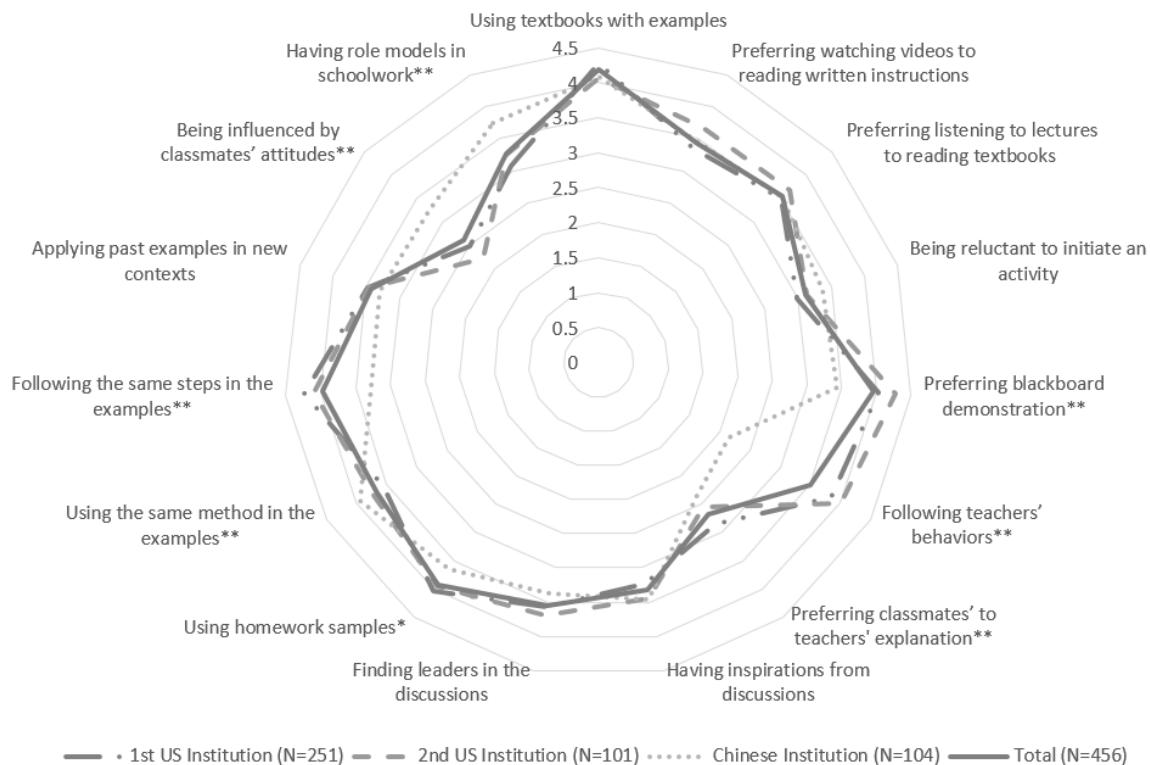
The gender, grade-level, and disciplinary variations in students' perceptions of the effects of imitations on learning are presented in Figure 2. Female students reported perceiving positive effects of 15 imitations than male students, with significantly more positive effects on seven imitations – Effects of watching videos rather than reading written instructions, initiating an activity, blackboard demonstration, homework samples, observing others' mistakes, observing successful examples, and live demonstration. Juniors and seniors reported perceiving more positive effects of 16 imitations, and significantly more in nine ones – Effects of using textbooks with lots of examples, following teachers' behaviors, discussing schoolwork with others, homework examples, observing others' mistakes, applying past examples in new contexts, classmates' positive attitudes, live demonstration, and having examples, while one significantly less positive effect of having leaders in discussions. Non-science and math students reported perceiving more positive effects of 12 imitations, but with more significantly less positive effect of listening to lectures rather than reading textbooks than students in science and math.



**Figure 2. Gender, Grade-level, Disciplinary Differences of Undergraduate Students' Perceptions of Effects of Imitation on Learning.**

### ***Undergraduate Students' Uses of Imitation in Learning***

The means of 456 undergraduate students' responses to 16 items in Questionnaire One are presented in Figure 3. Overall, students showed agreement (Mean  $> 3.00$ ) to 14 items, that is, they tended to perform these imitations while learning. Exceptions occurred in items for Preferring classmates' rather than teachers' explanations ( $M = 2.68$ ,  $SD = 1.07$ ) and Being influenced by classmates' attitudes ( $M = 2.61$ ,  $SD = 1.22$ ). As for individual institutions, students in the first U.S. institution showed agreement on 13 items. Exceptions occurred in items for Being reluctant to initiate an activity ( $M = 2.98$ ,  $SD = 1.32$ ), Preferring classmates' rather than teachers' explanations ( $M = 2.85$ ,  $SD = 1.07$ ) and Being influenced by classmates' attitudes ( $M = 2.49$ ,  $SD = 1.10$ ). Students in the second U.S. institution showed agreement on 14 items, with exceptions for two items, Preferring classmates' rather than teachers' explanations ( $M = 2.55$ ,  $SD = 1.19$ ), and Being influenced by classmates' attitudes ( $M = 2.22$ ,  $SD = 1.12$ ). Students in the Chinese institution showed agreement on 14 items, with exceptions for two items: Following teachers' behaviors ( $M = 2.16$ ,  $SD = 1.18$ ) and Preferring classmates' rather than teachers' explanations ( $M = 2.38$ ,  $SD = .84$ ).

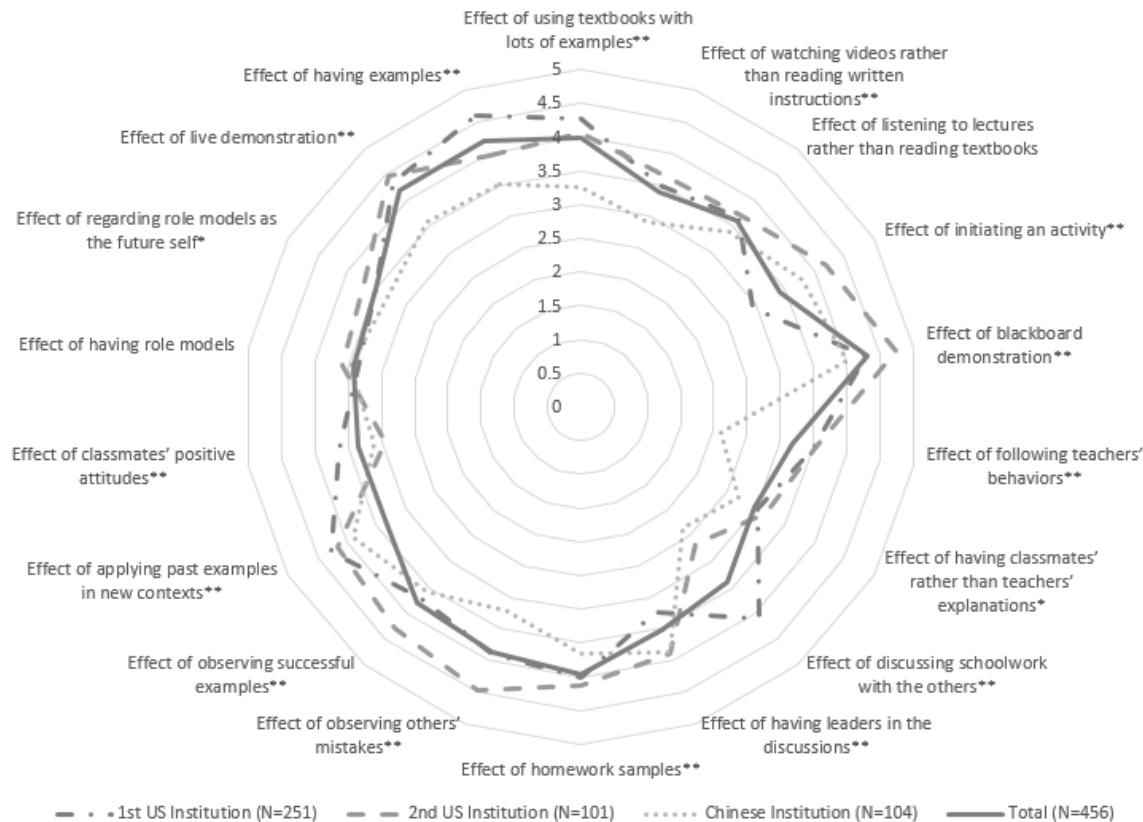


**Figure 3. Means of Undergraduate Students' Uses of Imitations in Learning.**

MANOVA is used to determine whether there were significant univariate main effects for institutions of undergraduate students' responses to the uses of imitations (SPSS version 21). \* $p < 0.05$ ; \*\* $p < 0.01$ .

To examine differences of students' uses of imitation across the three institutions, a multivariate analysis of variance (MANOVA) was conducted comparing student responses from the three separate institutions. Results of the MANOVA on Questionnaire One demonstrated a significant multivariate effect for institutions, Hotelling's  $T = 1.09$ ,  $F = 14.91$ ,  $p < .000$ , partial eta squared = .36. Power to detect the effect was 1.000. Given the significance of the overall test, the univariate main effects were examined. Significant ANOVA tests for institutions were obtained for eight items of using imitation in learning – Preferring blackboard demonstration ( $p = .00$ ), Following teachers' behaviors ( $p = .00$ ), Preferring classmates' to teachers' explanations ( $p = .00$ ), Using homework samples ( $p = .01$ ), Using the same method in the examples ( $p = .00$ ), Following the same steps in the examples ( $p = .00$ ), Being influenced by classmates' attitudes ( $p = .00$ ), and Having role models in schoolwork ( $p = .00$ ).

Significant institutional pairwise differences of students' uses of imitation were further examined. Students in the two U.S. institutions showed significant differences to three items – Preferring watching videos ( $p = .02$ ), Preferring blackboard demonstrations ( $p = .04$ ), and Preferring classmates' to teachers' explanation ( $p = .02$ ). Students in the first U.S. and Chinese institutions showed significant differences to ten items, including six



**Figure 4. Means of Undergraduate Students' Perceptions of the Effects of Imitations on Learning.** MANOVA is used to determine whether there were significant univariate main effects for institutions of undergraduate students' responses to the perceptions of the effects of imitation on learning (SPSS version 21). \* $p < 0.05$ ; \*\* $p < 0.01$ .

out of seven imitations in Learning Activities, two out of the three imitations in both Problem Solving Processes and Learning Attitudes. Students in the second U.S. and Chinese institutions responded significant differences to eight imitations, including four imitations in Learning Activities, one imitation in Problem Solving Processes, and all the three imitations in Learning Attitudes.

#### ***Undergraduate Students' Perceptions of the Effects of Imitations on Learning***

The means of 456 undergraduate students' responses to 18 items in Questionnaire Two are presented in Figure 4. Overall, students showed agreement (Mean  $> 3.00$ ) to 17 items, that is, they agreed on the positive effects of these imitations on learning. The only exceptions occurred in items for Effect of having classmates' rather than teachers' explanations ( $M = 2.98$ ,  $SD = 1.06$ ). Students showed highly positive impacts of three items (Mean  $> 4.00$ ) on their learning, including Effect of blackboard demonstration ( $M = 4.32$ ,  $SD = .82$ ), Effect of live demonstration ( $M = 4.18$ ,  $SD = .95$ ), and Effect of having examples ( $M = 4.20$ ,  $SD = .99$ ).

As for individual institutions, students in the first U.S. institution agreed on the positive effects of 17 items on learning with the only exception as Effect of initiating an activity ( $M = 2.93$ ,  $SD = 1.22$ ), and the highly positive effects of seven imitations. Students in the second U.S. institution agreed on the positive effects of 16 items on learning with exceptions for Effect of discussing schoolwork with the others ( $M = 2.66$ ,  $SD = 1.24$ ) and Effect of classmates' positive attitudes ( $M = 2.95$ ,  $SD = 1.32$ ), and the highly positive effects of eight imitations. Students in the Chinese agreed on the positive effects of 14 items on learning with exceptions for Effect of watching videos rather than reading written instructions ( $M = 2.91$ ,  $SD = 1.18$ ), Effect of following teachers' behaviors ( $M = 2.12$ ,  $SD = 1.19$ ), Effect of having classmates' rather than teachers' explanations ( $M = 2.70$ ,  $SD = .83$ ), and Effect of discussing schoolwork with the others ( $M = 2.34$ ,  $SD = .88$ ), but they did not report any imitations having highly positive impacts on their learning.

Results from the MANOVA on students' perceived impacts of the imitations on their learning demonstrated a significant multivariate effect for institutions, Hotelling's  $T = 2.04$ ,  $F = 24.64$ ,  $p < .000$ , partial eta squared = .51. Power to detect the effect was 1.000. Given the significance of the overall test, the univariate main effects were examined. Significant univariate ANOVA tests for institutions were obtained for 16 items of the effects of imitation on learning, excluding Effects of listening to lectures rather than reading textbooks ( $p = .10$ ) and Effect of having role models ( $p = .19$ ).

Significant institutional pairwise differences of students' perceived impacts of imitation on their learning were further examined, using MANOVA. Students in the two U.S. institutions showed significant differences to eight items, including Effect of initiating an activity ( $p = .00$ ), Effect of blackboard demonstration ( $p = .00$ ), Effect of discussing schoolwork with others ( $p = .00$ ), Effect of having leaders in the discussions ( $p = .00$ ), Effect of observing mistakes ( $p = .00$ ), Effect of observing successful examples ( $p = .00$ ), Effect of the classmates' positive attitudes ( $p = .00$ ), and Effect of having examples ( $p = .00$ ). Students in the first U.S. and Chinese institutions showed significant differences to 14 items, excluding Effects of listening to lectures rather than reading textbooks ( $p = .06$ ), Effect of observing successful examples ( $p = .28$ ), Effect of having role models ( $p = .39$ ), and Effect of regarding role models as future self ( $p = .13$ ). Students in the second U.S. and Chinese institutions responded with significant differences to 14 items, excluding Effect of listening to lectures rather than reading textbooks ( $p = .05$ ), Effect of having leaders in discussions ( $p = .87$ ), Effect of classmates' positive attitudes ( $p = .35$ ), and Effect of having role models ( $p = .43$ ).

## Discussion

Previous research of imitation in university teaching tended to regard imitation as a low-level cognitive copying behavior that was most useful in infancy or early childhood. The assumption had been that cognitively developed university students do not need to use imitation because its effect on learning is minimal, or those students should not use imitation because imitation might inhibit their creativity in learning. While recent research provides an updated understanding of imitation that it is a high-level cognitive ability and

plays an essential role in teaching and learning. Therefore, this study sought to fill a gap in current studies on imitation by exploring undergraduate students' use of perceived imitation across three institutions representing two different cultures, and providing practical suggestions for effective university learning and teaching.

The findings suggested that undergraduate students reported using imitation in all four dimensions of learning (Learning Materials, Learning Activities, Problem Solving Processes, and Learning Attitudes). Results further showed that students indicated in their responses that they learned better when using imitations, which highlighted the significance of imitation in undergraduate students' education. In addition, self-reports indicated that there were differences across genders, grade-levels, disciplines, and institutions in the perceived use and usefulness of undergraduate students' imitation. These differences were most pronounced when exploring for cultural variations in the uses and usefulness of imitation between U.S. and Chinese students. These findings provided suggestions for further research on undergraduate students' use of imitation across cultures, and may have important and practical implications for students and teachers in understanding imitation and using it effectively in higher education.

### ***Imitation as an Effective Learning Tool in Higher Education***

The central finding, that undergraduate students reported using imitation in learning, supported the results of previous research in developmental psychology, indicating that imitation exists and develops throughout adulthood (Meltzoff, 2005; Meltzoff & Decety, 2003). Most of the imitations undergraduate students used are delayed imitation, such as when the teacher is lecturing, students will observe and save those actions, and imitate the actions when they meet similar problems later. Delayed imitation required students to make connections across time and contexts, which involved more cognition in the process. Therefore, in their responses, undergraduate students indicated high-level cognitive abilities in evaluating current contexts and choosing what and how to imitate in those contexts. This also enabled students to use different actions or methods to achieve their goal, which led to what has been described in the literature as a genuine imitation (Eckerman, 1993). While using delayed imitation, undergraduate students reported flexibility and creativity in finding examples. If they did not have access to live demonstrations, they would search for print examples instead. Students imitated pre-existing examples, and also created opportunities for new examples, such as discussions with teachers or peers. Besides imitating their own previous experience, students imitated others' ideas and experience as well. They imitated not only each other's behaviors, but also attitudes and thinking, as noted in previous research (Cook & Bird, 2011; Warnick, 2008).

This study further found that undergraduate students reported using imitation as an effective learning tool, as suggested in developmental psychological studies (Hurley & Chater, 2005; Rogers & Williams, 2006). These results echoed previous findings on the positive effects of various activities or processes in learning. For example, the highly positive impact of exemplification on students' learning was aligned with Bender (1979) and Warnick's (2008) research on role models. The positive effect of live demonstrations on learning, such as lecturing or blackboard demonstration, contributed to Schaal's (1999)

proposal that teacher's demonstrations help students learn effectively, and Schaal, Ijspeert, and Billard's (2003) conclusion that demonstrations will significantly speed up the learning process. Students' responses suggested a strong preference for watching videos rather than reading written instructions as an enhancement for learning. This result was in line with the findings that dynamic visualizations are more effective than static visualizations (Höffler & Leutner, 2007; Tversky & Morrison, 2002; Van Gog et al., 2009). U.S. students' report of frequent imitations of teachers' behaviors provided a better understanding of the positive association between instructional behaviors and students' engagement in learning (Schroeder et al., 2011). Students' reports on the highly positive impacts of discussions, contexts, and delayed imitation on their learning was aligned with Lave and Wenger's (1991) theory of situated learning and the model of a community of practice. By supporting these studies, the findings from this study highlighted the critical role of imitation in learning. Students indicated imitating more when they were exposed to live demonstrations, examples, or role models, and, when they imitated, they tended to follow the same methods or even the same steps in the examples. This in turn led to their perceptions of more effective learning. Therefore, being able to imitate effectively across time and contexts may have a significant impact on undergraduate students' learning.

Self-reports showed gender, grade-level, and disciplinary differences in undergraduate students' uses and perceived usefulness of imitation. Female students used imitation more overall and reported more significantly positive of effects of imitation than male students. Upperclassmen used imitation more cognitively and perceived greater benefit from doing it than underclassmen, such as Freshmen and sophomores tended to imitate behaviors, while juniors and seniors reported more delayed imitations. Science and math students used imitations in more direct ways and delayed imitation as well. This may reflect discipline-distinct teaching practices, such as the specific procedural features of scientific and math instruction.

### ***Imitation as an Effective Teaching Tool in Higher Education***

Results further suggested that imitation can be used as an effective teaching tool. Teachers should consider how to effectively develop and guide students' imitations in curriculum and instruction. For instance, examples play an important role in undergraduate students' imitation and learning; therefore, teachers may choose textbooks with more examples, utilize examples from various resources such as videos or real life stories, and provide more demonstrations or homework samples. Teachers may also facilitate students' imitations by organizing discussions or introducing successful examples in school works to enhance students' learning. Students reported a high preference towards learning from observing others' mistakes; therefore, when introducing new content, teachers may use activities such as asking students to identify or correct mistakes. Teachers should also pay attention to the functional aspects of their behaviors in guiding, encouraging, or even reminding students in class.

While students from all three institutions reported uses of imitation in all four dimensions of learning, there were interesting differences in their endorsement of both the use and

usefulness of imitation in learning. For instance, U.S. students claimed that they were not influenced by others' attitudes and students in the first U.S. institution showed a very slight preference towards having role models in schoolwork. But students also claimed that role models had highly positive impact on their learning. The significant differences between students' reports on the positive effects of imitating others and using this imitation in learning demonstrated that holding one particular belief does not automatically give preference to the use of certain strategies (Purdie, Hattie, & Douglas, 1996). Therefore, teachers should help students realize that imitating role models, including classmates' positive attitudes in group discussions or in class, may have positive impacts on learning. Emphasizing students' positive attitudes or introducing role models in schoolworks or having leaders in group discussions might encourage students to use imitation more effectively.

Undergraduate students' genuine imitation in the classrooms has two essential components. The first component is that students need to react to the behaviors they observed, and the other one is that students' reactions should be related to some behaviors. Teachers expect that the behaviors students related to are the behaviors they are supposed to observe. Unfortunately, that is not always the case in classrooms. Students might make wrong connections. Therefore, in order to enhance students' effective imitation in learning, teachers need to explicitly explain their expectations of students' reactions before the activities, thus to direct students to make correct connections. For example, when explaining a math problem, teachers should tell students that they expect them to pay attention to the procedures and to use these procedures in solving similar problems. Thus, students' imitation will be guided to the procedures rather than the results and students might be able to save and perform the procedures later.

This study showed that undergraduate students reported the ability to find examples, but at the same time, they showed less creativity in using these examples – they reported a high preference towards imitating the same method or even the same steps in the examples. Another important problem was the significant difference between students' reports on imitations across time and contexts. Although 92.6% of the undergraduate students agreed or strongly agreed that delayed imitation was critical to learning, only 57.4% of them reported using delayed imitation in learning. Therefore, it is important for teachers to encourage students to use imitation more consciously, such as by helping students to develop the ability to understand the context of observed behaviors, to save these examples for later use, and to connect various behaviors across time and contexts; thus students can see learning as a dynamic long process rather than isolated individual activities.

### ***Imitation as an Effective Tool in International Education***

Undergraduate students in different cultures reported different uses and perceptions of imitations, which aligned with previous research on the critical role of imitation in culture transition and development (Rogers & Williams, 2006; Williamson et al., 2010). Generally speaking, U.S. students reported more uses of imitation and perceived a much more positive effect of imitation on learning than Chinese students did.

Chinese students reported being influenced by classmates' attitudes, having role models, and showing more reluctance in taking the lead by initiating a class activity. They also indicated perceiving a more positive effect from having leaders in discussions. This may be a reflection of the culture of Chinese education – a cautiousness to avoid being different or receiving attention in groups with an emphasis on collaboration and role models. Teachers' blackboard demonstration and having homework samples are the routines of Chinese education, which might explain the significant differences between U.S. and Chinese students' uses of these imitations. Contrary to U.S. students, Chinese students reported significantly lower endorsement of imitating teachers' behaviors in class and disagreed with the positive effects of most behavioral imitations on learning activities. Again, this echoes Chinese cultural norms which underemphasize the use of a lot of behaviors in communication, in contrast to American cultural norms in which people tend to give continuous behavioral feedback. These findings supports McCroskey et al. (1996)'s proposal that culture influences the relationship between imitation and cognitive learning, and points to a need for further studies on the effects of culture on students' imitation and learning.

These findings have potentially significant implications for international education. With a greater understanding of the cultural influences on students' learning, both U.S. and Chinese institutions would become better prepared to contribute the success of international students.

### ***Implications for Future Research***

This study is among the first studies on adult imitation in undergraduate educational settings. The findings have contributed to the existing literature on human imitation, suggesting the critical role of imitation in undergraduate students' learning and teaching, and highlighting cultural influences in students' imitation and learning. However, a number of issues need to be taken into consideration in future work.

The two questionnaires had strong reliability statistics (Cronbach's alphas for the Questionnaire One and Questionnaire Two were 0.87 and 0.90), and the Cronbach's alpha between the two questionnaires was 0.94. But two subcategories in Questionnaire One – imitation in learning activities (.69) and imitation in problem solving processes (.63), and one subcategory in Questionnaire Two – the effects of imitation in problem solving processes (.68) – had relatively weak reliability. Because this was an exploratory study examining both overt and covert imitation, all subcategories were used in the analysis. No measures of both overt and covert imitation currently exist, and while the questionnaires for this study have limitations, the measure does represent an initial attempt to explore a phenomenon that it is not easily measured. In this study, several students wrote their experience of imitation in learning at the end of the questionnaires, such as imitating mistakes. These qualitative information was also collected, and the possibility of interviewing focus groups might help with future revisions of the questionnaires as well.

Another limitation concerns the dimensions of learning examined in the present study. Inspired by Cantonia et al. (2011)'s questionnaire about the undergraduate students' con-

ceptions of learning, and based on definitions and previous findings of imitation (Hurley & Chater, 2005; Meltzoff, 2002, 2005, 2007; Meltzoff & Decety, 2003; Rogers & Williams, 2006; Warnick, 2008), this study examined imitation in four dimensions, namely, learning materials, learning activities, problem solving process, and learning attitudes. Learning is so complicated that any generalization of the conclusions is limited to these aspects. Future studies may either expand or refine these dimensions of learning to generate a more comprehensive understanding of undergraduate students' imitation.

This study used a self-report method to examine undergraduate students' imitation. Students were told clearly at the beginning of each questionnaire that they should focus on imitation in their learning. Students needed to situate themselves in various contexts to reflect on their experiences; thus it might be possible that they took other factors into consideration while answering the questionnaire. Therefore, additional evidence from non-self-report measures – such as students' interviews, students' learning outcomes or classroom observations – may contribute to a more complete picture of undergraduate students' imitation across cultures.

## Conclusion

Imitation is a high-level cognitive ability that emerges in infancy and develops throughout adulthood (Meltzoff & Decety, 2002). It is associated with a variety of cognitive skills such as motor skills, communication, emotion, and intelligence (Hurley & Chater, 2005). The present study presented an updated understanding of what imitation is and how it can be developed and used in university learning and teaching. By examining U.S. and Chinese undergraduate students' imitation, results suggested that

- Undergraduate students from both cultures used various imitations in learning and perceived those imitations to have positive effects on their learning.
- Gender, grade-level, disciplinary, and especially, cultural differences of undergraduate students' uses of imitation and their perceptions of the usefulness of those behaviors varied in ways that suggest the significance of broad norms when using imitation in undergraduate teaching and learning.
- Undergraduate students reported using imitations in learning materials, activities, and attitudes, and problem solving processes, such as using examples and preferring live demonstrations, following the methods and steps in examples, preferring imitating others in class activities, imitating each other's ideas in discussions, having role models in schoolwork, perceiving role models as their future selves, and applying past examples in new contexts; and U.S. students automatically followed teachers' behaviors in class and Chinese students reported being influenced by classmates' attitudes.
- General educators should develop and guide these students' imitations in curriculum and instruction by providing examples and demonstrations in various activities, from various resources, and via various media, encouraging role models, and making conscious connections between current and previous knowledge and experience.

The findings contributed to a better understanding of the significance of imitation in undergraduate student education, provided implications for teachers and students in using imitation as an effective teaching and learning tool, and offered important avenues for future research on the topic.

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